ENGINEERING EVALUATION/ COST ANALYSIS SUPPORT SAMPLING PLAN

FOR

REMOVAL ACTIVITIES

AT THE

TOLEDO TIE TREATMENT SITE

LOCATED AT

ARCO INDUSTRIAL PARK
TOLEDO, OHIO

MARCH 1998
(Revised December 1998)
(Amended January 2000)

Prepared For:

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Summary of Amendments to Engineering Evaluation/ Cost Analysis Support Sampling Plan

1.0 No Amendments

2.0 No Amendments

3.0 Section 3.0 amended in its entirety to reflect new Chemicals of Concern (COCs)

4.0 Section 4.0 amended in its entirety to reflect modified sampling approach

5.0 Section 5.0 amended to reflect the change from uppermost saturated unit to uppermost water-bearing lacustrine zone. Number of ground-water monitor wells has been modified from 8 to 12. Section 5.3.2 amended to reflect new sample designation. Sections 5.3.3.3 and section 5.3.3.4 amended to reflect the reference to placing plastic sheeting around ground-water monitor wells was removed.

6.0 Section 6.0 amended to reflect the change from uppermost saturated unit to uppermost water-bearing lacustrine zone.

7.0 No amendments

8.0 No amendments

9.0 Section 9.0 amended to reflect the updated scope of work schedule

10.0 Section 10.0 amended to reflect the modified project management team.

Table 1 added to show sampling matrix of media and parameters.

Figure 3 Amended to reflect modified sampling location map.

Figure 4 Changed to reflect sampling scheme for soil stockpile area (original Figure 4 removed.

Figure 5 Added to show preliminary schedule

New Appendix title pages included to correspond with text.

New Appendix B added to show CPT/LIF Documentation.

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1.0 INTRODUCTION

1.1 General

The United States Environmental Protection Agency (U.S.EPA) issued a Unilateral Administrative Order (UAO), dated December 24, 1997, to Kerr-McGee Chemical Corporation, now known as Kerr-McGee Chemical, LLC (Kerr-McGee) pursuant to Section 106(a) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) pertaining to the Toledo Tie Treatment Site (Site), which is located in and near the Arco Industrial Park in Toledo, Ohio (Figure 1). The Site was formerly operated by others as a wood treating facility, which primarily used creosote to treat wooden railroad ties.

The UAO, with an effective date of January 20, 1998, requires Kerr-McGee to conduct removal activities to abate an imminent and substantial endangerment to the public health, welfare or environment that may be presented by the actual or threatened release of hazardous substances at or from the Toledo Tie Treatment Site. Eight response activities, as described in Section V, Items 3.1 through 3.8 of the UAO, are required. The first seven response activities (Section V 3.1 - 3.7) are addressed in the Removal Action Work Plan prepared by Hull & Associates, Inc. (HAI) (HAI Document No. PWM001D.002) and Field Sampling and Analysis Plan (HAI Document No. PWM001D.003) dated April 1998, which were approved by the U.S. EPA.

This document addresses Section V, Item 3.8 of the UAO, which requires Kerr-McGee to *"conduct investigation activities necessary to support an Engineering Evaluation/Cost Analysis (EE/CA) for consideration of non-time critical alternatives for removal and stabilization of remaining sources of coal tar creosote and related hazardous substance contamination to soil, sediments and surface water at the Site and complete an EE/CA Report consistent with U.S. EPA guidance entitled, "Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA," EPA/540-R-93-057, Publication 9360.32, PB 93-963402, dated August 1993."*

1.2 Purpose and Objectives

As described in the Scope of Work (SOW) dated December 16, 1997, attached to the UAO, the following four tasks are to be completed under removal activity 3.8:

1. Task 1 - EE/CA Support Sampling Plan (SSP)
2. Task 2 - EE/CA Support Sampling
3. Task 3 - Data Report
4. Task 4 - EE/CA

This document fulfills the requirements of Task 1, the EE/CA SSP. The objectives of the EE/CA SSP are to further determine the extent of contamination for the purpose of identifying source areas at the Site beyond those already identified by other Site investigation data, and to gather data necessary to analyze and evaluate removal alternatives. This plan contains a description of equipment specifications, required analyses, sample types, and sample locations and frequency. It also addresses specific hydrologic and hydrogeologic characterization methods, and data requirements for removal technologies that will be evaluated in the EE/CA. Whenever appropriate, references have been made to Standard Operating Procedures (SOPs) provided in Appendix A. While this document details sampling and analysis procedures, it is not meant to be a stand-alone document, and should be used in conjunction with the Quality Assurance Project Plan (HAI Document No. PWM001D.001), included as Appendix C of the Removal Action Work Plan (HAI Document No. PWM001D.002), dated April 1998.

Under the EE/CA Scope of Work, the SSP will investigate the following areas that are shown on Figure 2:

1. Former location of Williams Ditch
2. Former Process Area
3. Former Treated and Untreated Railroad Tie Storage Areas
4. Stockpiled Material on property along Frenchmens Road
5. Access Road (former Creosote Road)
6. Former "Deep" Water Supply Wells

7. Soils beneath Distribution Warehouse

8. Additional areas discussed in Section 4.2.8

Pursuant to the precepts of the Superfund Accelerated Cleanup Model (SACM) and the EE/CA, existing data will be used to the maximum extent practical. These data include technical reports currently lodged in the Administrative Record and background information in the files of the Ohio EPA, Division of Emergency and Remedial Response. Existing hydrogeologic information has been evaluated by Kerr-McGee and HAI to determine additional data requirements necessary to define the distribution of creosote-related contamination for the purpose of evaluating appropriate removal actions, if any, in these areas. In addition, information collected during the investigation for the time-critical removal action will be evaluated by Kerr-McGee and HAI to supplement site characterization and data requirements regarding potential areas of contamination and migration pathways.

1.3 Data Gathering Objectives

Although limited environmental investigations have been conducted at or near the Site, as discussed in Section 2.0, the data are insufficient to effectively evaluate remedial alternatives. The EE/CA field sampling will provide additional data and is flexible to allow modifications (e.g. sampling locations, depths, etc.) based on conditions observed during field activities. The objectives of the data collection are to:

1. characterize suspected waste soil piles behind the distribution warehouse for potential treatment and disposal

2. define the hydrogeologic conditions in the uppermost saturated lacustrine zone at and near the Site, including but not limited to flow direction, discharge/recharge areas, and local groundwater uses. The distribution of creosote-related contaminants in the lacustrine zone will be evaluated as will the pollutant mobility and potential hazards to exposed receptors

3. characterize the flow and chemical quality of surface water traveling along Williams Ditch

4. define the extent of coal tar creosote related contaminants in surface and subsurface soils at the Site, including potential contamination in sediments in the former location of Williams Ditch

5. evaluate remedial alternatives and perform a Streamlined Risk Evaluation

1.4 Project Team

The sampling team will consist of a field operations coordinator (team leader) and a technical support group. The team leader's responsibilities will consist of: ensuring that data are collected within the constraints of this plan and the QAPP (HAI Document No. PWM001D.001); maintaining primary communication between the HAI sample team and HAI project manager; and reporting potential health and safety threats imposed by equipment, weather, site conditions, geography, or hazardous materials. A core project team has been selected based on individual project experience related to the specific tasks required. Additional HAI personnel and subcontractors will also be used as necessary to complete the work. A brief description of each core team member's project responsibilities is provided in the Removal Action Work Plan (HAI Document No. PWM001D.002).

1.5 Special Considerations

Site access is likely to be tenuous because the Site is composed of numerous parcels, each with different owners conducting different businesses. Therefore, as was done with the time-critical portion of the project, an informational meeting will be held with the property owners, business personnel, and other interested persons prior to initiation of EE/CA related field activities. The meeting will familiarize neighboring businesses with the investigative activities and the work schedule, and allow coordination of project activities that may interfere with traffic and/or normal business operations. Presumably, the timing and context of the meeting will be coordinated with the U.S. EPA. Details covered during this meeting will include safety issues, site access requirements, decontamination procedures, materials storage, drilling techniques, and other field methods.

Access to certain areas of the site, particularly the City of Toledo Streets, Bridges and Harbors property and the area behind the distribution warehouse, will be limited. A large stockpile of leaves covers a good portion of the City property. Heavy vegetation is present across the area behind the distribution warehouse. Clearing and grubbing will be necessary to facilitate access. Chipped wood and debris will remain on-site and used as needed to construct access roads or pathways across the Site.

All appropriated health and safety precautions, including PPE and air monitoring/sampling, as prescribed in the Health and Safety Plan (HAI Document No. PWM001T.049) will be followed. Individual Job Hazard Analyses will be conducted and reviewed with field and support staff prior to initiating field work.

1.6 Summary of EE/CA Approach

The overall approach to completing the EE/CA will be consistent with the U.S. EPA guidance document "*Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA*" EPA/540-R-93-057, August 1993. The Site contains five U.S. EPA identified areas of concern. Two additional areas were identified by Kerr-McGee as a result of further research and observations during the time-critical activities. A combination of geophysical and intrusive techniques will be used to acquire data from these areas of concern to support the evaluation of alternatives addressing residual creosote-related contamination at the Site after completion of the time-critical removal action. Geographic Information Systems/Global Positioning Systems (GIS/GPS) will be used to develop an historical overview of Site development and manage the data generated by the EE/CA support investigation. Laser-induced florescence (LIF) and cone penetrometer testing (CPT) will be used in conjunction with conventional sampling and analysis methods to determine the distribution of creosote contaminants. This approach has been selected because it can investigate large areas in a relatively short period as compared to more conventional methods. It also produces little, if any, investigation derived wastes that may require special handling or prove to be a health risk. Furthermore, this approach has been successfully demonstrated at other wood-treatment sites and has received a verification statement from the U.S. EPA Environmental Technology Verification Program (EPA-VS-SCM-01). The LIF/CPT technology and procedures are described in detail in Section 4.4.1 and Appendix B. The EE/CA sampling program is intended to be flexible, in order to respond to field conditions encountered.

2.0 SITE INFORMATION

2.1 Site Location and History

The Site encompasses over 50 acres and is located in the City of Toledo, Lucas County, Ohio, as shown on Figure 1. The Site was owned and operated by Federal Creosoting Company (FCC) from approximately 1923 to 1959, and American Creosoting Corporation (ACC) from 1959 to 1962. Operations ceased in 1962 when the Site was sold to the City of Toledo. In 1969, the Site was sold to Arco Realty, Inc. who subdivided the Site into a number of parcels and developed the area as a business and industrial park.

While operated by FCC and ACC, wooden railroad ties were treated with coal tar creosote at the Site. Based on a review of aerial photographs dated 1950, 1957, 1963, and 1969, a generalized wood-treating operations map was created (Figure 2). Figure 2 illustrates that untreated lumber was apparently stored in the eastern section of the Site, and treated wood was likely stored in the western and central sections of the Site. An aboveground storage tank (AST) farm was located in the south-central section of the Site, south of the access road formerly known as Creosote Road. The Ohio Environmental Protection Agency (OEPA) reported in the Site Inspection Report (SI, 1993) that the process area consisted of two 500,000 gallon, three 30,000 gallon, and four 150,000 gallon creosote tanks, and one 150,000 gallon zinc chloride tank. Suspected waste lagoons were located in the central section of the Site, north of the access road. Based upon review of aerial photographs, it appears the suspected lagoons, east of Arco Drive and south of Frenchmens Road, were filled between 1969 and 1972. A distribution warehouse, used only for storage of tires, is situated over a portion of one of the suspected lagoons, which based on aerial photographs, was most likely just a natural topographic depression.

Williams Ditch serves as the "natural drainage" in the area. When the Site was operated as a wood treating facility, the ditch ran southwest to northeast along the western section of the Site. The ditch generally intersected what are now Arco Drive and Frenchmens Road at approximately a 45 degree angle. A portion of the ditch was rerouted during redevelopment of the area, presumably to align with individual parcel boundaries.

Aerial photographs or photocopies of aerial photos from 1940, 1950, 1957, 1963, 1969, 1972, 1974, 1980, 1988, and 1998 are available to define locations of various areas of the former wood-treating facility. Geraghty & Miller (1990) conducted a review of historical photographs and topographic maps. The results of this review are generally consistent with Site features presented on figures in reports from numerous investigations at and near the Site. However, there are some minor discrepancies with respect to the exact location of some of the Site features such as the lagoons, due to interpretation of the photographs.

The most recent site-specific topographic mapping, based upon available information, is a 1974 map prepared for the Lucas County Planning Commission. Other previous topographic information includes United States Geologic Survey maps from 1934, 1952, 1965 and 1980; however, these maps lack detail. Survey ground control to support the EE/CA field activities is in place at the site.

2.2 Environmental Setting

The Site (Figure 1) is located on a relatively level piece of property approximately 4,500 feet north of Swan Creek and 8,000 feet south of the Ottawa River. The Site gently slopes toward Williams Ditch, which crosses the Site from southwest to northeast. Elevations across the Site range from 620 to 625 feet above mean sea level (msl).

The Site lies within the Eastern Lake Plains of the Central Lowland physiographic province of North America. This glaciolacustrine landscape typically possesses low relief and low elevation. This flat surface was created due to several widely spaced periods of continental glaciation that supplied the largely unsorted unstratified surficial drift deposits that cover the land in this area of the state. During the most recent stages of ice retreat, released water became trapped between the retreating ice mass to the north and the glacial deposits to the south, and proglacial lakes formed. These lakes produced a thin veneer of lacustrine deposits over the glacial tills (White, 1982; Forsyth, 1967).

More specifically, the surficial lacustrine deposits consist of two distinct types: silt and clay deposits representing quiet water deposition and sand deposits representing higher energy environments (i.e., near shore)(Kunkle, 1971). The lacustrine deposits are approximately 12 to 15 feet thick at the Site and range from silt to clay to sand. Depth to groundwater in the uppermost saturated zone has been documented between 3 and 5 feet below the ground surface. Water table conditions exist across the

Site, with stiff to very stiff glacial till clay typically encountered at 12-15 feet beneath the surficial lacustrine material. This till layer provides a low-permeability barrier to vertical migration of water and contaminants. In his 1995 masters thesis, Lesniak (University of Toledo) reports that the lacustrine/till interface is likely a lateral migration pathway for groundwater and potentially present dense non-aqueous phase liquids (DNAPL). Observations during excavation of the suspected lagoon area west of the distribution warehouse were that a stiff lacustrine clay/silt layer was present at approximately 8 feet below ground surface. DNAPL was observed at this interface. These observations generally correspond with the CPT/LIF data generated in April 1998, by Kerr-McGee.

The Ohio Department of Natural Resources (ODNR) Division of Geological Survey Drift Thickness Map of Lucas County, Ohio (ODNR, 1985) indicates that the Site is located on the southern slope of a buried valley where the drift thickness is approximately 125 feet. The buried valley traces from the southwest to the northeast and reaches a maximum depth of approximately 150 feet north of the Site. The glacial drift overlies Devonian limestone or dolomite bedrock.

The ODNR Groundwater Resources Map of Lucas County indicates that the principal aquifer beneath the Site consists of the thin discontinuous sand and gravel lenses interbedded in the clay till filling the preglacial valley. Yields of approximately 10 to 20 gallons per minute (gpm) are encountered at depths of 120 feet or less. However, higher yields may be obtained from the underlying carbonate aquifer. A municipal water supply system that draws water from Lake Erie serves the Site and vicinity, and local groundwater use for potable purposes is likely minimal to non-existent based on an ODNR water well search.

A number of hydrogeologic investigations were conducted at the Site between 1987 and 1995. Key documents describing site conditions include the "Initial Investigation and Preliminary Risk Assessment" report dated June 27, 1990, by Midwest Environmental Consultants, "The Hydrogeology and Creosote Contamination of an Abandoned Wood Preserving Plant Site at Toledo, Ohio," report dated December 1995, by Greg Victor Lesniak of the University of Toledo, and the 1993 Ohio EPA Site Inspection Report (SI). Results of soil, groundwater, and surface water samples collected from the Site during these investigations indicated contamination from creosote compounds existed near the suspected lagoons, former process area, and Williams Ditch. Individual polyaromatic hydrocarbons (PAHs) detected included naphthalene, benzo(a)pyrene, phenanthrene, chrysene, fluoranthene, acenaphthalene, pyrene, and dibenzo (a,h) anthracene. Concentrations ranged from 100s to 1,000s of parts per million (ppm) in soil, sediment, and surface water samples. Investigations conducted by the Ohio EPA in 1993 and the Ohio Department of Health in 1995 determined that sediments in some areas of Williams Ditch were saturated with creosote. These observations were generally confirmed during investigation activities conducted by Kerr-McGee as part of the time-critical removal. References for previous environmental investigations can be found in Section 7 of the 1993 SI report prepared by the Ohio EPA. These reports are generally consistent in describing the geologic and hydrogeologic conditions at the Site. New data collected during implementation of the EE/CA SSP will supplement existing data to refine the understanding of subsurface conditions at the Site.

The Administrative Record for the Toledo Tie Treatment Site reports that on September 25, 1997, following a significant rain event in Toledo, Ohio, the National Response Center was notified of the presence of a sheen of an unknown composition in Williams Ditch. On October 1, 1997, representatives of U.S. EPA Emergency Response Branch evaluated conditions in Williams Ditch and observed a sheen upgradient of the National Super Service storm sewer outfall to Williams Ditch. The sheen was characterized as very heavy in the ditch east of Arco Drive (50 to 100 feet) and north (50 to 100 feet) of the former location of the suspected creosote lagoon areas. This area of heavy sheen coincides with the location of a storm sewer apparently running through the former lagoon area to Williams Ditch.

At the request of the U.S. EPA, Kerr-McGee initiated abatement activities to preclude sheen migration in Williams Ditch on October 10, 1997, and continued these efforts until the issuance of the UAO. Suspected lagoon areas, considered immediate source areas, likely contributed contaminants to Williams Ditch and are being addressed in the time-critical removal action. The U.S. EPA identified five other areas of the Site as targets for this EE/CA SSP. Subsequently, Kerr-McGee has identified two additional areas to be addressed in this EE/CA SSP. Each area is briefly discussed below:

Former Location of Williams Ditch

Sections of Williams Ditch were rerouted after 1962 to facilitate property development. This investigation will attempt to locate the original sections of Williams Ditch and collect samples to determine if these areas are sources for contamination present in Williams Ditch. Concentrations of PAHs in the sediments of Williams Ditch ranged from 180 to 270 ppm in previous investigations.

Former Creosoting Plant and Tank Area

Historic records, aerial photographs, and the SI indicate that a process area with two 500,000 gallon, three 30,000 gallon, and four 150,000 gallon creosote tanks and one 150,000 gallon zinc chloride tank existed on the site. The aerial photographs also appear to indicate the presence of stained soils around the plant and tank area, although some of the stained soil may be cinders from the operation of coal-fired trains near on-site railroad tracks or treatment areas. Currently this area is wooded and sparsely covered with debris piles consisting of bricks, railroad ties, concrete rubble and fragments of tar in a dark brown to black fine grained soil matrix.

Former Treated and Untreated Railroad Tie Storage Areas

A 1957 aerial photograph indicates numerous stacks of treated lumber west of the process area. The largest number of treated lumber stacks appears to be located just west of the former Williams Ditch, north of Arco Drive, and extends all the way to Byrne Road. Analytical results of soil samples collected from property assessments indicate the presence of phenanthrene (1.56 ppm) and carbazole (0.046 ppm) in this area. The aerials also show the storage of apparently untreated lumber in the eastern portion of the site in the vicinity of the former "Creosote Road". Currently no analytical data are available regarding soils in this area.

Stockpiled Material on Properties Along Frenchmens Road

These stockpiled material piles are located behind the warehouse at 3243 Frenchmens Road. The stockpiled area is currently wooded and the piles of material are comprised of bricks, railroad ties, concrete rubble and fragments of tar in a dark brown to black, fine grained soil matrix. Samples of this material collected during a 1990 site assessment indicated the presence of four PAH compounds ranging in concentrations from 110 to 720 ppm.

Former Access Road (Creosote Road)

Based on a 1963 aerial photograph of the Site, the former Access Road or Creosote Road occupied approximately the same space currently held by Elmdale Road until just north of the intersection of Elmdale and Frenchmens Road. At this point, the access road turns east-northeast and continues for approximately 400 feet before making a 90-degree turn toward the south-southeast. Following the 90-degree turn to the south, the road extends approximately 300 feet, at which point it intersects an east-northeast/west-southwest trending road stretching from the railroad tracks to the east, to just west of the former creosoting plant and tanks.

Former Site "Deep" Wells

The 1921 and 1950 Sanborn maps indicate that two "deep" water supply wells likely existed near the former process area. These maps indicate the wells were used to supply water for fire hydrants and possibly the tie-treatment process.

Soil Beneath Distribution Warehouse

Based on the results of the time-critical investigation, a review of historical aerial photographs and observations during excavation activities in the suspected lagoon area, contaminants likely exist beneath the distribution warehouse located south of Frenchmens Road. The warehouse is currently used only for the storage of tires and is not occupied by people on a regular basis.

3.0 CHEMICALS OF CONCERN

The predominant Chemicals of Concern (COC) are polycyclic hydrocarbons (PAHs) associated with coal tar creosote. Evaluation of various petroleum hydrocarbons will aid in evaluating mobility potential, where as analysis for carbazol, phenols, creosols, and 2-methylnaphthalene will aid in characterizing creosote related contamination. Secondary contaminants that may affect remedial technologies consist of metals, also considered COCs for this investigation. These EE/CA SSP COCs were selected based on the outcome of previous investigations, available data regarding past use of the Site, and the objectives of this plan. Refinement of the COCs will be made after data from the EE/CA sampling are evaluated in terms of risk scenarios or removal alternatives applicable to the Site.

Based on analytical results of soil and sediment samples collected from the former lagoon areas and Williams Ditch during the time-critical removal action, the aforementioned are the only COCs for the Site. Pentachlorophenol (PCP) and other organic-halogens were not detected at the Site. Low levels (ppb range) of various pesticides have been detected on Site; however, pesticides are not included in the COC list because levels detected on the site are low and consistent with anthropogenic levels found offsite in this area. Much of the area surrounding the Site was predominantly used for agriculture.

In addition, review of historic aerial photographs, the Geraghty & Miller report (October, 1990), field observations, and the recently completed thesis work at the University of Toledo (Epstein, 1997), indicates that the soil piles behind the distribution warehouse are likely the result of site regrading and/or industrial redevelopment. The work of Epstein (1997) focused on the biodegradation of polycyclic aromatic hydrocarbons and creosote contaminated soil. Epstein reports that soil samples taken from the soil piles indicate organic compounds associated with creosoting operations

4.0 SOIL AND SEDIMENT INVESTIGATION

4.1 Soil Boring and Subsurface Investigation

The subsurface investigation consists of data collection activities to evaluate the subsurface stratigraphy in the upper unconsolidated material, determine contaminant distribution characteristics, and define geological influences that may control groundwater flow and contaminant transport. Indirect data collection methods (i.e., aerial imagery, laser induced fluorescence, cone penetration techniques and test pits) will be used as a preliminary screening tool. Direct sample collection methods consisting of hollow stem auger, hand auger, and direct push borings will supplement indirect data results, where applicable. Geophysical methods, coupled with test pits or trenching, will be used to locate suspected former water supply wells, as well as subsurface structures (should any remain) identified on historical documents. Field and laboratory analysis of subsurface materials will be used to define the lateral and vertical distribution of subsurface contaminants in the areas of concern identified in Section 2.0.

4.2 Sample Locations and Frequency

The EE/CA SSP activities for soil investigation will consist of using aerial imagery, CPT/LIF, soil borings, and test pits or trenching. Each of the areas of concern illustrated on Figure 2 will undergo one or more of these techniques based on historic property use, current access issues, and size of areas of concern. Proposed boring grids were established as a function of these issues. The initial perimeter of the proposed sample areas will be staked by survey according to the Site's datum control system. After the necessary clearing and grubbing, specific CPT/LIF boring locations will be placed by pacing and/or taping between known landmarks to achieve the minimum proposed grid spacing. Boring locations will be marked and surveyed for location and elevation following completion. The data collection grid spacing and data collection methods for each area are defined in the following sections.

The depth of each direct push technology boring will be determined by the following criteria, unless otherwise specified:

1. Direct-push technology borings will be advanced until CPT/LIF signature indicates the absence of creosote or until the base of the uppermost saturated unit (top of till) is encountered; and

2. For geoprobe borings, *if the till is fractured, the boring will be advanced to the base* of the fractures. If the borings penetrate the till, drilling operations will be stopped until new drilling procedures can be developed that will protect the underlying saturated units.

Up to eight hollow stem auger borings will be advanced to a depth of approximately 40 feet for the purpose of characterizing the geotechnical characteristics of the suspected zone(s) of creosote related contamination and the underlying glacial till. Samples for in-situ vertical permeability, grain size distribution, natural moisture content, specific gravity and plasticity characteristics will be collected. The location of these hollow stem auger borings will be determined in the field after the screening tools are used to define the lateral and vertical distribution of cresote related contamination. Double-casing will be used as appropriate to minimize the potential of creating an artificial conduit for potential contaminant migration.

Sampling locations are proposed, and the exact number and location of these sampling locations may change based on observed conditions in the field. Examples of when sample locations may change include, but are not limited to, the following:

1. buried or overhead utilities;
2. buildings or other structures;
3. subsurface obstructions;
4. surficial debris (such as leaf piles on City of Toledo property); and
5. presence/absence of impacted soils and/or groundwater.

Sample locations will be adjusted accordingly and the new location marked with a wooden lath.

CPT/LIF locations may also be modified under the following circumstances:

1. A series of similar LIF responses in an area strongly suspected of containing creosote contamination. In this instance, one might skip grid points and move directly to the suspected perimeter to more rapidly define the horizontal distribution of contaminants.

2. Conversely, if there is a consistent response at background levels, the CPT/LIF rig may be moved from that area closer to a suspected source area. Should contaminants be found, the CPT/LIF rig would be moved back towards the area exhibiting background levels until a limit of contamination was defined.

Any major deviations to the proposed sampling scenario will be discussed with the RPM to receive concurrence before making such adjustments.

This approach, in conjunction with the real time response of the CPT/LIF, allows for effective use of the drilling budget, as well as providing instantaneous data regarding the limits of contamination Thus, the approach also allows for "stepping out" when definitive limits of contamination are not defined. Each final boring location will be marked with labeled wooden lath and surveyed following completion of drilling. Sample identification nomenclature is subject to change based on the database limitations of the laboratory.

To determine the absence or presence of contaminant concentrations based on CPT/LIF response, and to verify stratigraphic conditions, soils will be sampled across the entire CPT/LIF response range using one of the direct sampling techniques described in Section 4.1. Soil samples for chemical analysis will be collected from the confirmatory borings based on visual contamination and field screening with a PID/FID or UV lamp. A soil sample from each of the following intervals will be collected and submitted for laboratory analysis, where applicable:

1. Ground surface to approximately six-inches below ground surface;
2. Two samples from within the zone identified as having a LIF signature indicative of creosote related contamination. One sample will be from the depth demonstrating the highest screening results (LIF signature, PID/FID or UV response); and
3. A depth below the LIF signature above background levels.

Sampling of soils at the perimeter of zones identified as having a LIF signature above background will be completed to confirm the lateral and vertical distribution of creosote related contamination. Borings in these areas will likely not have a measurable LIF response. The sampling scenario will include one sample each from the following intervals:

1. Ground surface to approximately six-inches below ground surface;

2. The depth corresponding to the highest screening results (i.e., LIF, PID/FID or UV) in the adjacent LIF signature zone; and

3. A depth below the LIF signature above background noted in the adjacent boring.

A summary of samples to be submitted for laboratory analysis, including chemicals of concern, is provided on Table 1.

4.2.1 Former Location of Williams Ditch

The location of the former Williams Ditch has been defined in approximate dimensions using aerial photographs. Direct-push technology will be used to complete boring profiles at former bends along the length of the ditch where existing conditions allow. Three borings will be placed perpendicular to the ditch on approximately ten-foot centers, and advanced to a depth of approximately 15 feet or until suspected ditch sediment is penetrated. This approach will allow for an examination of the vertical and lateral extent of potential contamination. PID/FID responses or UV examination will be used as a fieldscreening tool to assess the presence and distribution of creosote compounds. Soil samples for chemical analysis will be collected from these borings based on visual observations and field screening with a PID/FID or UV lamp. In the absence of a PID/FID or UV lamp response, one sample will be collected at each profile location from the ground surface to approximately six-inches below ground surface and another from the fill material of the former Williams Ditch (if it can be distinguished from native material). Should the profile borings indicate the presence of creosote related contamination, the sampling scenario will be the same as described in Section 4.2. The sampling location would be at the center of the former Williams Ditch. The approximate locations of the Williams Ditch borings are illustrated on Figure 3, although alternate locations may be completed based on observations in the field. For example, if unexpected results are observed, then additional profiles will be added to expand the area being examined.

4.2.2 Former Process Area

Soils in this area will be initially characterized using CPT/LIF borings. The proposed CPT/LIF boring investigation is composed of approximately 94 borings installed to an approximate depth of 15 feet as presented on Figure 3. In addition to these borings, 13 borings will also be placed in the footprints of the former storage tanks. Aerial photographs also show a surface feature, which is suspected to be a drainage pathway from the former tank area to one of the wastewater lagoons. Four CPT/LIF borings will be placed along the length of this former suspected drainage way. Confirmatory soil borings will be placed adjacent to a minimum of 15 percent of the CPT/LIF borings installed on the Site based on LIF response. To determine the absence or presence of contaminant concentrations based on CPT/LIF response, soils will be sampled across the entire CPT/LIF response range using one of the direct sampling techniques described in Section 4.1. Soil samples for chemical analysis will be collected from the confirmatory borings based on visual observations and field screening with a PID/FID or UV lamp.

4.2.3 Former Treated and Untreated Railroad Tie Storage Areas

The area where treated and untreated lumber was apparently stored will be investigated separately. Soils in these areas will be characterized using both CPT/LIF and geoprobe borings. The proposed boring locations within the former treated railroad tie storage areas are shown on Figure 3 and will consist of approximately 23 borings installed to an approximate depth of 15 feet. Confirmatory soil borings will be placed adjacent to a minimum of 15 percent of the CPT/LIF borings installed on the Site based on LIF response. To determine the absence or presence of contaminant concentrations based on CPT/LIF response, soils will be continuously sampled across the entire CPT/LIF response range using one of the direct sampling techniques described in Section 4.1. Soil samples for chemical analysis will be collected from the confirmatory borings based on visual observations and field screening with a PID/FID or UV lamp.

The proposed boring locations for the former untreated railroad tie storage area consists of randomly spaced CPT/LIF borings, direct-push borings, and hollow stem auger borings as illustrated on Figure 3. Target areas will be where historical and anecdotal evidence indicates potential black tie storage or product handling activities. Confirmatory geoprobe borings may be installed in this area based on LIF response to ensure that fifteen percent confirmation borings are installed on the Site consistent with the SSP.

Soil samples will be selected based on LIF response, visual observations and field screening with a PID/FID or UV light. Samples for chemical analysis will be selected at the intervals discussed in Section 4.2. If the analytical results indicate significant contamination, the SSP will be modified with the concurrence of the RPM. A revised sampling program for a CPT/LIF boring investigation along with confirmation samples will be proposed and implemented as part of the modified SSP.

4.2.4 Stockpiled Material

The approximate location of stockpiled material is shown on Figure 4. This material is easily identified in the field and consistent in nature, containing scraps of wood, railroad ties, concrete, soil, and assorted rubble. In addition, review of historic aerial photographs, the Geraghty & Miller report (October, 1990), field observations, and the recently completed thesis work at the University of Toledo (Epstein, 1997), indicates that the soil piles behind the Spartan Chemical building are likely the result of site regrading and/or industrial redevelopment. As shown on Figure 4, samples will be collected from the stockpiles based on a grid approach. Analytical data obtained from these samples will supplement information documented in the Geraghty & Miller report, SI by Ohio EPA, and the University of Toledo Thesis (Epstein, 1997).

The objective of sampling the stockpile material is to define the distribution of contaminated soils prior to the completion of clearing and grubbing activities, as well as to characterize this material for potential waste management purposes. The SI indicated primarily PAH contamination in one of these piles. Some sample location flags, associated with the fieldwork of a UT graduate student, may remain. It may be possible to collect some confirmatory samples at the previous sample locations to verify existing data. Visual evidence and anecdotal evidence from previous bioremediation experiments on the soil pile will also be used. Appropriate Health & Safety considerations will be employed during sample collection, including ambient air monitoring.

4.2.5 Former Access Road (Creosote Road)

The location of the former Access Road has been approximated using aerial photographs. However, due to the size of the former road and the limited number of current landmarks, the location of the road and boring locations must be transferred from the aerial photographs to the Site using accurate surveying techniques. When this is accomplished, CPT/LIF borings will be installed to evaluate the presence of a creosote-type signature at the staked locations as illustrated on Figure 3. If a signature above background is noted, the boring will be advanced until a background signature is obtained.

Confirmatory soil borings will be placed adjacent to a minimum of 15 percent of the CPT/LIF borings installed on the Site based on LIF response. Confirmation borings will be installed to approximately three feet using direct push techniques unless a creosote signature is encountered, as addressed above. If this occurs, the feasibility of hand auger techniques decreases with depth. Thus, a more feasible method will be proposed based on the final depth of the CPT/LIF boring. To determine the absence or presence of contaminant concentrations based on CPT/LIF response, soils will be continuously sampled and visually inspected and screened with a PID/FID. Based on the inspection and screening the soil sample that exhibits the greatest potential for the presence of contaminants and a sample below this interval will be submitted for chemical analysis. However, if no apparent contamination exists, a sample from the ground surface to approximately six-inches below ground surface will be submitted for analysis.

Confirmatory samples collected within three feet of the existing grade are proposed since this is a reasonable estimate of road thickness over time. Figure 3 shows the approximate location of the Access Road CPT/LIF borings. The SSP will be modified based on the analytical results of these samples (i.e.. if significant contaminants are encountered, a sampling program including a boring investigation and confirmation samples will be proposed and implemented).

4.2.6 Former Deep Wells

The 1921 and 1950 Sanborn maps indicate that two "deep" water supply wells likely existed near the former process area. The ODNR well log files were searched to see if information regarding the wells existed, but nothing could be found. The approximate locations of the "deep" wells based on the Sanborn maps are provided on Figure 3. The wells must be physically located and inspected. However, due to the size of the wells and the limited number of current landmarks, the location of the wells must be transferred from the Sanborn maps to the Site using accurate surveying techniques. When this is accomplished, the area will be searched first visually, then using a magnetometer, if needed, to determine the location of the "deep" wells. If debris interferes with the magnetometer study, then a backhoe will be used to excavate around the suspected locations to attempt to locate the former wells. When the wells are located, they will be inspected and sampled according to the procedures outlined in Section 5.0, if appropriate. The RPM will be notified if the well assessment suggests a modification to the SSP is necessary.

4.2.7 Soil Beneath the Distribution Warehouse

Based on the results of the time-critical investigation of the former lagoon areas, contaminants likely exist beneath the distribution warehouse located south of Frenchmens Road. Samples from borings collected during the time-critical investigation indicated creosote concentrations to the north and west of the warehouse. This SSP proposes investigating beneath, to the south, and east of the warehouse. To accomplish this task, the following items will be completed, if applicable:

1. five direct-push borings will be installed through the concrete floor within the warehouse; and

2. four CPT/LIF borings will be installed along both the south and east sides of the warehouse.

The depth of each boring will be advanced until CPT/LIF signature indicates the absence of creosote or until the base of the uppermost saturated unit (top of till) is encountered. As described in Section 4.2, if the borings penetrate the underlying confining layer, drilling operations will be stopped until new drilling procedures are developed that will protect the underlying units.

Sampling locations are proposed, and the exact number and location of these sampling locations may change based on observed conditions in the field (i.e., utilities, structures, obstructions, etc.). This approach, in conjunction with the real time response of the CPT/LIF, allows for "stepping out" when definitive limits of contamination are not defined (i.e., east and south of the warehouse). Each boring location will be marked with labeled wooden lath and surveyed following completion of drilling. Sample identification nomenclature is subject to change based on the database limitations of the laboratory.

Confirmatory soil borings will be placed adjacent to a minimum of 15 percent of the CPT/LIF borings installed on the Site based on LIF response. Analytical samples will be collected from intervals above, within, and below the zone with the highest LIF response (relative intensity) including where there is no LIF response, as described in Section 4.2.

4.2.8 Additional Areas of Potential Impact

Other areas of potential impact were noted by HAI upon review of the aerial photographic analysis completed by the U.S. EPA and additional site reconnaissance. These areas are tentatively identified as material handling or processing areas, or potential pits or piles. The approximate extent of these areas is presented on Figure 3. A combination of direct-push and CPT/LIF borings will be installed to evaluate subsurface conditions in these areas, consistent with the protocol described in Section 4.2.

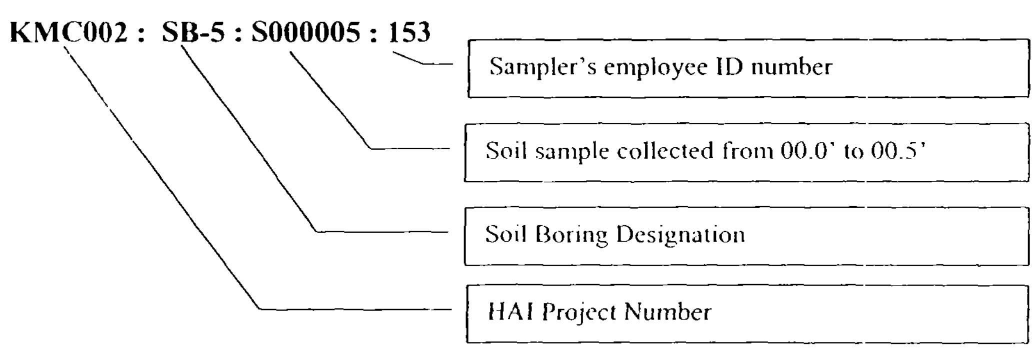
4.2.9 Additional Sampling

Additional soil and sediment samples were collected during the time-critical removal activities. Nine samples were collected from the bottom of the excavation area within the limits described in the Time-Critical Removal Plan after the immediate source was removed. These samples were analyzed for BTEX, PAHs and metals. Similarly, six samples were collected from Williams Ditch after removal of contaminated Sediment. Data from these samples will be used in the Streamlined Risk Evaluation.

4.3 Sample Identification (Labeling) and Designation (Numbering)

A unique sample identification number will identify each sample collected for chemical analyses. This sample identification numbering system was developed to aid in data management and provide a consistent format for Geographic Information System (GIS) applications. These sample numbers include several key pieces of information for GIS such as the sample location, sample type/matrix, and the sampled depth interval or date sampled. The other fields are required for project management.

An example of a valid sample number for a soil sample follows:



A detailed description of sample identification nomenclature is found on Table C.3 of the QAPP, as amended January, 2000.

4.4 Sampling Equipment, Supplies, and Instrumentation

Soil samples will be collected using one of the methods described in this section. The physical characteristics of the unconsolidated materials will be evaluated using either visual observations or CPT/LIF technology.

4.4.1 CPT/LIF

The physical characteristics of the unconsolidated materials will be evaluated to a depth of approximately 15 feet using the CPT and direct push technology. In accordance with ASTM Standard D 3441, the cone is typically advanced at a rate of two centimeters per second with the driving force of hydraulic rams. Sensors contained in the CPT tip continuously log tip pressure and sleeve friction. The data from these sensors correspond to soil type and are used to map generalized stratigraphy. Simultaneously with the CPT push, LIF spectroscopy will be used to determine the presence of a wide range of aromatic hydrocarbons in the soil including gasoline, jet fuel, diesel fuel, bunker oil, lubricating oils, crude oil, coal tar, and creosote. LIF spectroscopy is synonymous with the phrase Rapid Optical Screening Tool or ROST™. Essentially, the system consists of an excitation laser and fiber optics. Light from the laser passes through a sapphire window (located outside of the stainless-steel probe above the CPT tip) and is directed onto the soil as the CPT probe is advanced. The laser light fluoresces aromatics in the soils, and the fiber optics return this information to the surface. The intensity of the fluorescence corresponds to aromatic concentrations. Thus, this method provides qualitative and semi-quantitative information regarding PAH contamination in subsurface soils. The LIF information will be used to evaluate the horizontal and vertical distribution of creosote compounds in each area of concern. Specific methodologies and documentation regarding the CPT/LIF technology is provided in Appendix B.

Following review of the CPT/LIF results, confirmation sampling locations will be selected. At each of these, borings will be continuously sampled using direct-push technology, hollow stem augers and split spoons, or hand auger techniques, based on field conditions. Information collected from these borings will confirm stratigraphy evaluated using the CPT technology. Soil samples will also be collected and submitted for analysis from the location defined by the LIF results. Support of the soil sample submitted for analysis will be provided by headspace screening of soil samples using a PID/FID or UV lamp. The protocol for selecting sample intervals is described in Section 4.2.

4.4.2 Hollow Stem Auger Drilling

Hollow stem augering (HSA) will be performed in accordance with HAI SOP No. F2000 (Appendix A) following ASTM D 1586-84, Method for Penetration Test and Split Barrel Sampling of Soils. HSA drilling will be used to install monitoring wells. In addition, HSA drilling will be used to gather stratigraphic data and confirmatory soil samples to corroborate the CPT/LIF boring results where direct push methods are not feasible. HSA use will be limited due to the significant amount of Investigation Derived Wastes (IDW) that are generated.

4.4.3 Split-spoon Soil Sampling

Split-spoon soil sampling is explained in HAI SOP No. F3000, in accordance with ASTM Method D 1586-84. Each HSA soil boring will be continuously sampled. Standard Penetration Test (SPT) and headspace data will be collected and recorded on the boring log by the field geologist.

4.4.4 Shelby Tube Sampling

Relatively undisturbed soil samples will be collected using a thin-walled Shelby tube in accordance with ASTM D 1587-83 and HAI SOP No. F3001. Two Shelby tube samples will be taken from the fine grained cohesive soils (lacustrine clay and till) below the uppermost saturated zone to characterize the lower confining unit. Where applicable, these soil samples will be submitted to a laboratory and analyzed for pH, cation exchange capacity (CEC), moisture content and dry bulk density (ASTM D2216), USCS classification (ASTM D422), vertical hydraulic permeability (ASTM D5084 or ASTM D2434, as appropriate), Atterberg Limits (ASTM D4318), and total organic carbon (Walkley-Black). HAI will conduct the geotechnical analyses, Lancaster Laboratories will perform the pH and TOC analyses, and Ohio State Agricultural Extension, or similar agency, will perform CEC and organic matter content.

4.4.5 Hand Auger Drilling

Hand augering, if used, will be performed using a barrel auger in accordance with HAI SOP No. F3002 (Appendix A) following ASTM D 4700-91, Standard Guide for Soil Sampling from the Vadose Zone and ASTM D1452-95, Practice for Soil Investigation and Sampling by Auger Borings.

4.4.6 Direct-push Drilling

Direct-push technology drilling methods will be performed to collect soil samples for general characterization of soils, as well as to collect confirmation samples where appropriate. This method uses a hydraulic ram and hammer to advance a four-foot long, macro core sample with acetate liner through the strata. The sample is collected in the liner that is cut open with a razor knife to retrieve the sample. This method is desirable because it produces very little IDW.

4.4.7 Test Pit Installation

Test pits will be installed during this investigation in addition to soil borings to allow for characterization of stratigraphic conditions. The test pits will also be used to evaluate CPT/LIF data, as well as to provide a "first look" in areas where the CPT/LIF rig is not accessible. Test pits will be used as a screening tool to assist in locating CPT/LIF borings and hollow stem auger locations. Samples may be collected from test pits and submitted for geotechnical evaluation. Each test pit location will be surveyed according to the Site's grid system upon completion.

4.4.8 Head Space Screening with Photoionization Detector

Head space screening will follow HAI SOP No. F4008 (Appendix A). In summary, when the sample is collected, a portion will be placed in both a laboratory supplied sample container and a *Zip-loc* baggie. The baggie will be sealed and placed in a warm area for approximately five to 10 minutes to equilibrate. Following equilibration, the PID/FID probe will be inserted through the upper portion of the baggie to obtain the headspace reading.

4.4.9 Ultraviolet (UV) Fluorescence Field Screening

Ultraviolet (UV) fluorescence field screening of non-aqueous phase liquids (NAPL) will follow HAI SOP No. F4010 (Appendix A). In most cases, dense non-aqueous phase liquids (DNAPL) are generally more difficult to detect by visual and PID/FID methods. However, oils typically exhibit a degree of fluorescence in the present of ultraviolet light (Levorsen, 1954). Fluorescence examination entails viewing a portion of each sample in UV light. Thus, following headspace screening, the sample is examined in the viewing box in the presence of UV rays supplied by a portable battery-powered UV light capable of emitting longwave UV (3000-4000 A) light. The fluorescent colors of hydrocarbons range continuously from milky white to yellow through green to blue. Coal tar creosote typically fluoresces yellow-green to green.

4.5 Sample Handling, Preservation Methods, and Blank Samples

For quality assurance purposes, one field blank and one equipment blank will be collected for every 20 samples analyzed, or a minimum of one per day. The sample will be collected by decontaminating the sampler according to HAI SOP No. F1000 and then passing laboratory-supplied water through the sampler. The water will be collected in the properly preserved containers specified in Table C.2 of the QAPP. The sample will be analyzed for the same parameters described in Section 4.6.

Matrix spikes and matrix spike duplicate (MS/MSD) samples are addressed in Section 9.4 and 9.5 of the QAPP. Replicates and MS/MSD samples will be collected as dictated by the laboratory to meet the data quality objectives needed to complete the Streamlined Risk Evaluation. Samples collected for chemical or physical analysis will be stored in a manner to prevent the samples from freezing in cold weather. Samples collected in weather conditions above freezing for chemical analysis will be stored near 4°C by placing them on ice in an insulated container.

4.6 Sample Analysis Parameters

Soil and sediment samples will be analyzed for PAHs, phenol, creosols, dibenzofuran, and carbazole in accordance with U.S. EPA Method 8270, petroleum hyrdocarbons in accordance with U.S.EPA Method 8260, and metals in accordance with the U.S. EPA Methods 6000 and 7000 Series. Table C.2 of the QAPP identifies the analytical methods, data quality objectives, and QA/QC protocol for each sample matrix and location. To assist with contaminant transport modeling, samples will be analyzed for total organic carbon (TOC) in accordance with Walkley-Black Method. Up to five geotechnical analyses will be conducted including USCS classification (ASTM D 2487), vertical permeability (ASTM D5084) dry/wet density (ASTM D2216), and specific gravity (ASTM D584). The chemical parameter list is on Table C.1 of the amended QAPP.

A cursory review of the preliminary data will be conducted by HAI's Quality Assurance Officer prior to distribution. Although these preliminary data may be compiled into tables and used for initial risk evaluations and remedial design, decisions on a selected remedy and final risk evaluations will be made using validated data. These preliminary data, or the results of any initial evaluations based on preliminary data, will not be released until all investigative data have been validated and the results received by HAI.

An independent third-party data validator, Environmental Standards, Inc., will validate the analytical data collected from investigative samples. Data validation will consist of reviewing the analytical data against the criteria specified in the SW-846 or other applicable method guidance. The usability of these data will also be evaluated. The data validation results will be forwarded to Lancaster Laboratories, Inc. and Kerr-McGee. The laboratory will address any deficiencies and issue new analytical reports to Kerr-McGee, as necessary.

4.7 Chain-of-Custody

The chain-of-custody will trace possession and handling of individual samples from the time of collection at the Site through laboratory delivery and analysis. The chain-of-custody program consists of procedures for sample labeling, sample sealing, field log recording, record keeping, and laboratory logging.

Sample Labeling - All sample labels will contain the following information:

Project number
Soil Boring
Sample number
Name of the collector

The record keeping, sample seals, field log recording, and the laboratory logbook will adhere to the same procedures described in Section A.2.6 of the QAPP.

4.8 Soil Classification and Field Description Log

Samples will be classified in the field according to HAI SOP No. F1006 following ASTM Standard D2487-93.

4.9 Decontamination of Equipment

The soil sampling and profiling equipment will be decontaminated in accordance with HAI SOP No. F1000. The decontamination rinse water will be collected, containerized, and stored until proper disposal can be arranged.

4.10 Disposal of Unused Soil Samples

Extraneous soils that remain following sample collection will be properly stored in DOT approved 55-gallon drums and secured according to HAI SOP No. F2013. The drums will be clearly labeled with a permanent marker or paint pen. Label information will consist of site identification, type of material, generation date, and sampler's initials. The material in the drums will be characterized as discussed in Section 7.0. This material is considered IDW and is not considered a RCRA listed waste, but will be analyzed to determine if it is a characteristically hazardous waste under RCRA. The time frame for treatment and/or disposal will be based on the characterization. Documentation will consist of completing a chain-of-custody record as described in HAI SOP No. F3014 and Section C.5.0 of the QAPP. The drums represented by each composite sample will be noted on the "comments" section of the chain-of-custody.

4.11 Decommissioning of Soil Borings

The soil borings that are not converted to monitoring wells will be decommissioned according to HAI SOP No. F2002. If no significant caving occurs, the soil boring will be decommissioned with hydrated bentonite chips as directed by the field hydrogeologist. The surface will be finished to grade with concrete or vegetative soil commensurate with the original surface conditions.

5.0 HYDROGEOLOGIC INVESTIGATION

5.1 Objectives

The hydrogeologic investigation activities consist of installing monitoring wells, collecting one round of representative groundwater samples, measuring the pH, temperature, dissolved oxygen, and conductivity of ground water; determining the presence or absence of immiscible layers of non-aqueous phase liquid; and conducting in-situ tests (slug tests) to evaluate groundwater quality and hydrogeologic characteristics of the uppermost water-bearing lacustrine zone. The investigation will define:

1. the location of water-bearing units and the presence or absence of confining layers in the unconsolidated material;
2. hydrogeologic characteristics by conducting slug tests in select monitoring wells;
3. the general flow direction and gradient of groundwater in the uppermost water bearing zone; and
4. the distribution of creosote related contaminants in the uppermost water bearing zone

CPT/LIF results and confirmation soil boring information (i.e., stratigraphy, saturated horizons, and areas of contamination) will be used to help locate monitoring wells that reflect likely groundwater flow directions in relationship to zones of suspected contamination. The benefit of using the CPT/LIF technology is that areas of concern and general stratigraphy can be immediately identified in the field. Decisions about monitoring well locations to reflect likely groundwater flow direction in relationship to zones of suspected contamination can be made quickly in the field, without the standard lag time waiting for analytical results or installing monitoring wells based on "an educated guess" approach.

5.2 Monitoring Well Construction and Installation Procedures

5.2.1 Monitoring Well Locations

Approximately twelve monitoring wells will be installed into the uppermost water-bearing lacustrine zone. The exact location of these monitoring wells will be determined based on the CPT/ LIF screening and confirmation boring information regarding identified areas, sources and source areas, the need to define the distribution of creosote related contaminants in groundwater relative to potential receptor contact, and the need to evaluate groundwater flow. Monitoring wells will be installed to monitor the uppermost water-bearing lacustrine zone, and actual screen depths and lengths will be determined in the field by the field hydrogeologist based on the location of contaminants, confining layers, and saturated horizons. The objective of well screen placement is to intercept zones where raw free-flowing creosote product or soils saturated with raw, creosote product may be present in areas of contamination. Typically, this will be above a lower confining layer. Outside areas of contamination, screen placement will be dictated by the location of the confining layer interface. Data from the CPT and geoprobe borings will define the stratigraphy to facilitate screen placement. The proposed monitoring well locations are shown on Figure 3.

5.2.2 Monitoring Well Designation (Numbering)

Monitoring wells will be numbered sequentially beginning with MW-1 and may not correspond with the boring number.

5.2.3 Monitoring Well Installation, Equipment, and Procedures

5.2.3.1 Hollow Stem Auger Drilling

Monitoring wells will be installed using hollow stem augers in accordance with HAI SOP No. F2000.

5.2.3.2 Monitoring Well Construction Specifications

Each monitoring well will be installed in accordance with HAI SOP No. F2006. The monitoring wells will be constructed with two-inch diameter Schedule 40 Stainless Steel casing and 0.010-inch slotted screens. Once installed, a lockable protector pipe and bumper posts will protect the riser, where applicable.

5.2.3.3 Monitoring Well Development

Monitoring wells will be developed in a manner consistent with U.S. EPA Technical Enforcement Guidance Document (TEGD) protocol. Monitoring well development methods consist of bailing, surging, or over-pumping. The method used for each particular well will be determined by HAI based on observed field conditions. Water generated during development and slug tests will be contained in DOT approved 55-gallon steel drums and stored for proper disposal.

Prior to and following monitoring well development, relative groundwater levels and depths to water/product interfaces (if present) will be measured using an electronic water level indicator/interface probe. The water level will be measured relative to a marked surveyed point on the top of the monitoring well casing (TOC). The TOC survey will be established with a common horizontal and vertical datum established for the Site.

Proper monitoring well development consists of surging, then removing a minimum of three to five monitoring well volumes. Notes regarding the relative turbidity (visual), temperature, pH, and conductivity will be recorded following each monitoring well volume. If a monitoring well bails dry prior to removing the three to five well volumes, then an attempt will be made to redevelop the monitoring well after recovery. If recovery exceeds a reasonable time period (four to eight hours) then the monitoring well will be considered developed.

5.3 Monitoring Well Sampling

5.3.1 Sample Locations and Frequency

The proposed approach is to define the groundwater flow direction, gradient, and quality in the uppermost water-bearing lacustrine zone. One round of groundwater samples will be collected from the monitoring wells following development to characterize groundwater quality for the purpose of providing data to conduct a risk evaluation. The groundwater sampling event will consist of measuring water levels and immiscible layers (if present), purging, sampling, and measuring pH, conductivity, dissolved oxygen and temperature, as well as the parameters listed in Section 5.3.4. This data will be used in conjunction with stratigraphic information, analytical data, and the Conceptual Site Model (CSM) to conduct a risk evaluation. Further details of sampling procedures are outlined in the following discussions.

5.3.2 Sample Designation

Each groundwater data point will be identified according to the following SIN:

KMC002 : MW-5 : G012500 : 157

- Sampler's employee ID number
- Date
- Monitoring Well Designation
- HAI Project Number

Note: Sample designations may change based on database limitation.

5.3.3 Sampling Equipment and Procedures

The procedures that will be performed at each monitoring well include:

1. measuring for immiscible layers;
2. measuring the static water level;
3. purging the monitoring well;
4. collecting the field groundwater sample; and
5. performing hydrogeologic characterization tests (slug test).

5.3.3.1 Detection of Immiscible Layers

Floating (light phase) and/or sinking (dense phase) immiscible liquids, if present, will be measured in monitoring wells using an interface probe. Light non-aqueous phase liquids (LNAPL) will be detected by carefully lowering the interface probe down into the monitoring well until the approximate static water level is reached (i.e., water/immiscible layer interface). DNAPL will be detected by carefully lowering the probe to the bottom of the monitoring well. See HAI SOP No. F3006 for a detailed description of the procedures used to detect immiscible layers. Decontamination procedures in accordance with HAI SOP No. F1000 will be followed.

5.3.3.2 Water Level Measurements

An electronic water level indicator will be used to measure the static water level elevation in each monitoring well. As a substitute, an interface probe may also be used to obtain water level measurements. Groundwater measurements will be conducted in accordance with HAI SOP No. F3005. Each measurement will be recorded to the nearest one-hundredth of one-foot using the Site datum. Total depth measurements of the monitoring well will also be taken with the water level indicator or the interface probe. However, it will be necessary to add a correction factor (the distance from the sensor to the tip of the probe) to the resulting measurement. In addition, monitoring well volume will be calculated as discussed in HAI SOP No. F3007. A detailed description of the procedures to be used when collecting water samples is found in HAI SOP No. F3008. Decontamination procedures, in accordance with HAI SOP No. F1000 will be followed.

5.3.3.3 Monitoring Well Evacuation (Purging)

Prior to collecting data, each monitoring well will be purged in order to obtain a representative sample from the formation. HAI SOP No. F3007 outlines the appropriate purging procedures. Clean surgical gloves will be worn by all personnel handling the purging equipment.

A minimum of three volumes of water will be removed from the monitor well prior to sampling. The monitoring well will be purged in a manner that minimizes groundwater agitation. Low-yielding monitoring wells will be completely evacuated and sampled following adequate recovery. Temperature, pH, and specific conductance measurements will be recorded following each monitoring well volume purged. The sampling equipment will be calibrated according to the manufacturer's specifications.

Monitoring wells may be purged using any of the following methods: a two-inch *Grundfos* stainless steel submersible pump, a *Keck SP-84 Sampling-Pump System*, a *Voss* disposable polyethylene bailer, a *Waterra* hand pump or a *Brainard-Kilman pump*. If the total volume to be purged from the monitoring well is less than 20 gallons, it may be more efficient to purge the monitoring well by hand using a bailer or the *Waterra* hand pump.

Purging equipment will be decontaminated with a non-phosphate detergent wash, followed by a potable water rinse, and a deionized water rinse. In order to further minimize the potential of carry-over contamination between monitoring wells, a small volume of potable water will be discharged through the purge pump and hose to flush the system as discussed in HAI SOP No. F1000. Purge water will be containerized on-site in DOT-approved 55-gallon steel drums properly labeled to await proper disposal.

5.3.3.4 Sample Withdrawal

A *Voss* disposable bottom-valve bailer or similar device will be used for collecting samples from each monitoring well. A dedicated polypropylene rope or nylon string will be used to lower the bailer into the monitoring well and collect the sample. Clean gloves will be worn by each individual handling the samples and sampling equipment. The following steps will be adhered to during sampling:

1. the integrity of the check valve for each bailer will be tested with deionized water to assure that no fouling problems exist that may reduce the delivery capability or result in aeration of the sample;

2. the bailer will not be dropped into the monitoring well, as this may cause degassing of the water on impact;

3. the bailer contents will be transferred into the proper sample container in a manner that will minimize agitation and aeration; and

4. in order to preserve sample quality, the sample collection will be as follows: volatiles, semi-volatile organic compounds, metals, and in-situ parameters (e.g., pH, specific conductance and temperature).

Used sampling equipment including string, gloves, or other protective clothing, will be properly disposed of following contact with groundwater. Waste sampling equipment will be temporarily stored in a plastic trash bag until it can be transported to the dedicated waste receptacle for storage at the Site.

5.3.4 Analytical Parameters – Groundwater

Analytical parameters for groundwater characterization consist of PAHs, BTEX, and metals.

5.4 Slug Tests

A slug test requires a rapid displacement of water in a monitoring well, creating a distinct change in water level. The saturated zone response to this change in water level is a return to equilibrium (static water level). The rate of return to static conditions is a function of the hydraulic conductivity of the saturated horizon and the geometry of the monitor well. In-situ hydraulic conductivity tests will be performed in accordance with HAI SOP No. F4002 to determine the hydraulic conductivity of the screened portion of the formation. The Bouwer and Rice Method for analyzing slug test data will be used to calculate hydraulic conductivity, which will be supported by *Aqtesolve*, if necessary. Slug tests will be performed on five representative monitoring wells. The test locations will be determined by the hydrogeologist following installation and development.

6.0 SURFACE WATER INVESTIGATION

6.1 Objectives

The surface water investigative activities consist of measuring water levels along Williams Ditch to determine stream gradients and the possible interconnectivity with the uppermost water-bearing lacustrine zone. Surface water quality is being addressed in the time-critical phase of the investigation.

6.2 Surface Water Sampling Procedures

6.2.1 Sample Locations and Frequency

Stream gauges SG-1 through SG-4 will be installed along Williams Ditch as indicated on Figure 3. The stream gauges will be measured on the same day as the monitoring well water levels. This data will be used to determine the gradient of Williams Ditch from Byrne Road to Hill Avenue. It will also be used in conjunction with the monitoring well water level data to define flow direction and gradient in the uppermost water-bearing lacustrine zone. Surface water samples will be taken at each location and tested for the site COC's for soil and sediment. In addition, samples of surface water and sediment will be collected from manholes, where accessible, along the route of the Williams Ditch enclosure, in the southwest corner of the Site, from the upstream origin to where the enclosure discharges into Williams Ditch along Arco Drive.

6.2.2 Measuring Equipment and Procedures

The procedures performed at each sampling location consist of installing a calibrated stream gauge, surveying the gauge into the Site datum, and measuring and recording water levels at each gauge prior to conducting work on the stream or during a groundwater sampling or water level measurement event. Stream gauges will be checked monthly, concurrent with the water levels in the monitoring wells, for a period of six months. Kerr-McGee and HAI will review the data at this time to evaluate any apparent hydraulic connectivity between the uppermost water-bearing lacustrine zone and Williams Ditch. These items are discussed in the SOPs in Appendix A.

7.0 INVESTIGATION DERIVED WASTE CHARACTERIZATION

Investigation-derived wastes will be characterized using the TCLP Method of Analysis in accordance with EPA Method 1311 and subsequent analyses for volatile organic compounds (VOCs) by U.S. EPA Method 8260 and metals by U.S. EPA Methods 6000 and 7000 series. Waste material will also be analyzed for ignitability, pH, cyanide and sulfides. Additional analyses may be required by the accepting waste disposal facility.

8.0 TESTS FOR REMOVAL ALTERNATIVES EVALUATION

The EE/CA will evaluate presumptive remedies for the removal actions for this Site. Samples will be analyzed, and treatability studies will be potentially conducted as part of this SSP to help assess the presumptive remedies. The presumptive remedies to be evaluated involve bioremediation (ex-situ or in-situ), thermal desorption, immobilization, and incineration. Alternate technologies, such as in-situ soil washing or applying institutional controls may be considered depending upon Site conditions encountered during the additional investigation activities.

For the evaluation of bioremediation, up to five grab soil and/or sediment samples will be collected and analyzed for indigenous microorganisms, moisture content, pH, nutrients, organic content, particle size, and total organic carbon. These samples will be selected from areas of gross contamination where bioremediation may be applicable. For evaluation of potential in-situ bioremediation, additional samples of reduction/oxidation potential and Fe^{+2} and Fe^{+3} may be collected.

For the evaluation of thermal desorption and incineration as remedial options, up to five representative soil and/or sediment samples will be analyzed for bulk density, metals, moisture content, particle size, pH, plasticity, total organic carbon, total chloride, and flash point.

For evaluating the option of immobilization, up to five representative soil and/or sediment samples will be analyzed for cyanides, halide content, inorganic salts content, metals content, organic content, bulk density, particle size, and solids content.

An appropriate laboratory or firm with documented experience in treatability studies would be retained, if appropriate. A representative sampling approach, consistent with the guidelines in EPA document PB92-963408, Removal Program Representative Sampling Guidance, Volume 1- Soil, will be employed to evaluate treatment and disposal options.

9.0 SCHEDULE

9.1 Schedule

This section presents the project schedule for implementing the EE/CA SSP, preparing a data report (Task 3 of the Scope of Work), and preparing the EE/CA report (Task 4 of the Scope of Work). The schedule is shown on Figure 5. The schedule of field activities reflects a phased approach to assessing the Site. Milestones are set for delivery of data summaries to the US EPA, following the completion of each phase of field work.

The time frame presented is appropriate to complete the EE/CA for the following reasons:

1. Field observations indicating significant clearing and grubbing will be necessary to access the former process area and the stockpiled material behind the former distribution warehouse;

2. the time lag to receive validated analytical data; and

3. the scope of the time-critical removal action which removed the immediate source of creosote related contamination to Williams Ditch and Frenchmens Road which represents the greatest exposure risk.

Consistent with Section §300.415(9)(f), this time frame allows for more effectively making the transition from the time critical activities into a remedial mode, as well as evaluating the potential implications of including components of Ohio's Voluntary Action Program into the EE/CA. This is particularly important given the commercial setting of the Site, beneficial reuse of the properties and the on-going disruption of business activities. Several weeks of site preparation and utility checks are anticipated prior to authorizing mobilization of field crews. Clearing and grubbing along with Site surveys will be the first tasks. Mobilization of off-site contractors to perform the CPT/LIF investigation will take approximately three weeks after receiving a notice to proceed. The UAO stipulated that the work plans be implemented "within 10 days of receipt of such approval in accordance with the schedule approved by the U.S. EPA". Clearing and grubbing or locating the deep wells would commence within this time frame.

10.0 PROJECT MANAGEMENT TEAM

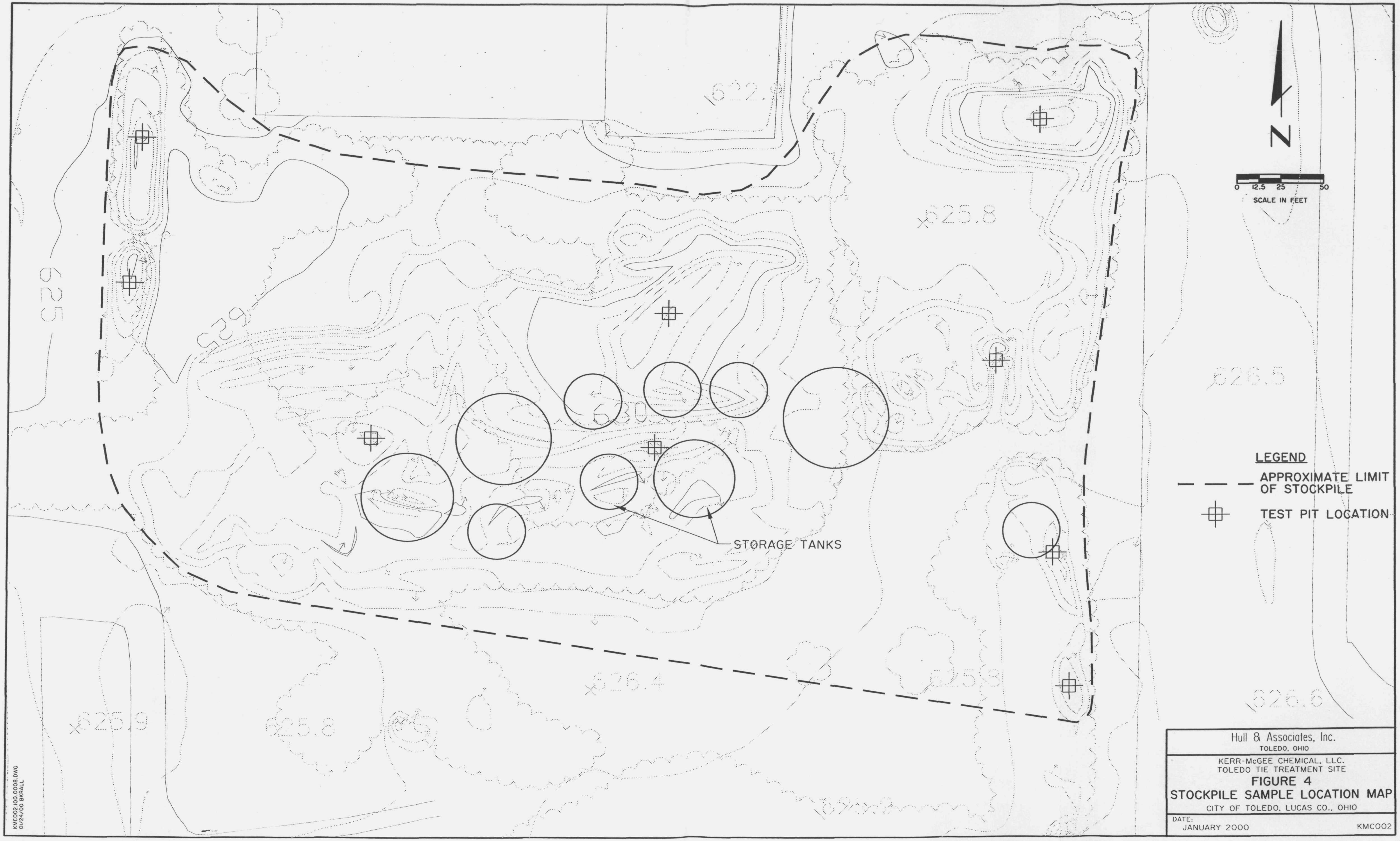
10.1 Project Personnel

Personnel	Contact Number	Affiliation
Ralph Dollhopf	734-692-7682	U.S. EPA On-Scene Coordinator
Heather Nelson	312-353-0685	U.S. EPA Remedial Project Manager
Ron Nabors	419-352-8461	Ohio EPA Project Contact
A. Keith Watson	405-270-3747	Kerr-McGee Project Manager
Scott Lockhart, P.E.	419-385-2018 419-323-0789 (pager) 419-304-5845 (mobile)	Hull & Associates, Inc. Project Manager
Tom Covrett	419-385-2018 419-304-5859 (mobile)	Hull & Associates, Inc., Field Operations Coordinator
Craig Kasper, P.E.	614-793-8777	Hull & Associates, Inc., Technical Support and Peer Review
Bud Tjandra	419-385-2018	Hull & Associates, Inc.. Technical Support
Eric Cherry	614-793-8777	Hull & Associates, Inc., Technical Support
Steve Weldert	513-459-9677	Hull & Associates, Inc., Risk Assessment
Kevin Wildman	614-793-8777	Hull & Associates, Inc. QA Officer
Christopher Schraff	614-227-2097	Legal Counsel for Kerr-McGee

Scott Lockhart, Project Manager for Hull & Associates, Inc., will serve as a central point of contact between Kerr-McGee and the U.S. EPA on technical issues associated with completing the EE/CA support sampling and the EE/CA report. He will provide review and coordination of HAI and other contractors that may be retained by Kerr-McGee to comply with the UAO. A. Keith Watson, Project Manager for Kerr-McGee retains the ultimate decision making authority for issues which may transcend technical implementation of the EE/CA and related to enforcement, compliance with the order and changes in the scope of work.

Hull & Associates, Inc. (HAI) has been retained by Kerr-McGee to complete the project plans required by Section V, Item 3 of the UAO. In this capacity, HAI will direct and coordinate the collection and evaluation of additional field data that will be needed to implement the tasks described in Section 1.0 of this work plan. Mr. Scott Lockhart, P.E., will serve as the Project Manager for HAI and will be responsible for the technical and administrative aspects of the project, communication with the Project Coordinator and Kerr-McGee and coordination as needed with the U.S. EPA during the course of developing and implementing project plans. Technical support and peer review will be provided by Mr. Craig Kasper, P.E., Mr. Tom Covrett, P.E., Mr. Bud Tjandra, Mr. Eric Cherry, Mr. Kevin Wildman, and Mr. Steve Weldert of HAI.

FIGURES



N
0 12.5 25 50
SCALE IN FEET
622.9
625.8
625
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630
626.5
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626.6
625.9
625.8
STORAGE TANKS
LEGEND
APPROXIMATE LIMIT OF STOCKPILE
TEST PIT LOCATION
Hull & Associates, Inc.
TOLEDO, OHIO
KERR-McGEE CHEMICAL, LLC.
TOLEDO TIE TREATMENT SITE
FIGURE 4
STOCKPILE SAMPLE LOCATION MAP
CITY OF TOLEDO, LUCAS CO., OHIO
DATE:
JANUARY 2000
KMC002
KMC002.100.0008.DWG
01/24/00 BKRALL

SDMS US EPA Region V

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FIGURE 5

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TABLES

MEDIA SAMPLING MATRIX

TABLE 1

SUMMARY OF PROPOSED SAMPLING LOCATIONS AND CHEMICALS OF CONCERN

Media	SVOCs[1] 8270	Metals TAL	Test Pits	CPT/LIF	Geoprobe	Hollow Stem Auger	Monitor Wells
Williams Ditch (sediment)	X[2]	X[2]			4		
Williams Ditch (surface water)	X[2]	X[2]			4		
Former Location of Williams Ditch (sediment/soil)	X[2]	X[2]			21		1
Former Process Area (soil)				94		5	2
Former Treated and Untre Railroad Tie Storage Area (soil)				23		1	1
Stockpile Material[4] (soil)	X[2]	X[2]	9				
Former Access Road Creosote Road (soil)	X[2]	X[2]		6	3		
Former Deep Wells (ground water)	X[2]	X[2]					
Soil Beneath the Distributi Warehouse (soil)	X[2]	X[2]		8	5		
Additional Areas of Poten Impact (soil)	X[2]	X[2]		45	25	3	8
Confirmatory Samples	X[3]	X[3]			X[3]		

(1) Chemicals of concern for SVOCs include PAHs, carbazole, creosols, phenols, and 2-methylnapthalene

(2) Number of samples submitted will be 15% of total CPT/LIF borings completed on the site.

(3) Confirmation samples will be collected from locations where the LIF signature is above backgrround, as well as below.

(4) Stockpile material will be analyzed for additonal chemicals of concern including VOCs

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PLATE A-4a (RECORD DRAWING FOR CPT, GEOPROBE AND TEST PITS/TRENCHES)

☐ **Other:**